

Serial No. 09/935,012

PATENT
Docket No. 58027-011500

Claim 40 (original): The vertical cavity surface emitting laser of claim 31, wherein the doped tunnel junction is p-doped with CBr₄.

Claim 41 (original): The vertical cavity surface emitting laser of claim 31, wherein the VCSEL operates in the approximate range from between 1.3 microns and 1.6 microns.

Claim 42 (original): The vertical cavity surface emitting laser of claim 31, wherein the pair of mirror portions include a first mirror portion positioned on a top of the active region and a second mirror portion positioned below the active region.

Claim 43 (previously added): A distributed Bragg reflector for use in a vertical cavity surface emitting laser, comprising a plurality of layers of semiconductor material doped to reduce voltage drop and optical loss in a vertical cavity surface emitting laser, the plurality of layers including at least one layer having the element antimony (Sb) and at least one layer having the compound indium phosphide (InP), wherein the plurality of layers are substantially lattice matched to an InP substrate.

Claim 44 (previously added): The distributed Bragg reflector according to claim 43, wherein the element Sb and the compound InP are included in alternating layers.

Claim 45 (previously added): The vertical cavity surface emitting laser according to claim 17, wherein wherein the element Sb and the compound InP are included in alternating layers.

Claim 46 (previously added): The vertical cavity surface emitting laser according to claim 31, wherein the element Sb and the compound InP are included in alternating layers.

REMARKS

Responsive to the Final Office Action of May 6, 2003, reconsideration of the above application is respectfully requested.

Independent claims 1, 12 and 43 are rejected under 35 U.S.C 103(a) as being unpatentable over Sugiyama *et al.* (US. 5,392,307) in view of Yang *et al.* (US. 5,805,624); and,

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independent claims 17 and 31 are rejected under 35 U.S.C 103(a) as being unpatentable over Sugiyama *et al.* (US. 5,392,307) in view of Yang *et al.* (US. 5,805,624) and further in view of Jayaraman *et al.* (WO 98/07218).

Sugiyama *et al.* teaches a VCSEL structure having DBRs made from alternating layers of AlGaAsSb and InAlAs materials, primarily to have small conduction band offsets between the alternating AlGaAsSb and InAlAs DBR materials (col. 6, lines 41-65); whereas, Yang *et al.* suggests a DBR made from an InP material (col. 2, lines 7-12).

The Examiner contends that it is obvious to combine Yang's InP based DBR with Sugiyama's AlGaAsSb/InAlAs (or AlGaAsSb/InGaAlAs) based DBR to reject the independent claims of the present invention.

Respectfully, the Applicants' disagree with the Examiner. Firstly, nowhere Sugiyama *et al.* disclose, suggest or teach an InP layer in a DBR. In fact, even if it were possible to include the InP layer from Yang's DBR in Sugiyama's DBR, to form either an AlGaAsSb/InP DBR, or AlGaAsSb/InP/InAlAs DBR, or AlGaAsSb/InP/InGaAlAs DBR, this would significantly increase the conduction and valence band offsets between these layers. This combination would be contrary to what is required by Sugiyama's invention (*viz.*, small conduction band offsets between the DBR layers as disclosed in col. 6, lines 41-65), and would induce a "band-bending" effect causing the forward-directional resistance of the VCSEL device to increase substantially (col. 2, lines 40-52 in Sugiyama *et al.*). Therefore, it would be inappropriate to combine Yang with Sugiyama, since it would result in a DBR and a VCSEL device having a worse performance than the original DBR and VCSEL device of Sugiyama.

The law does not permit a proposed modification that would render the prior art invention being modified unsatisfactory for its intended purpose where there is no suggestion or motivation to make the proposed modification (see *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). Furthermore, if the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified (*viz.*, combining Yang with Sugiyama causing an increase in the conduction band offset thereby making worsening the

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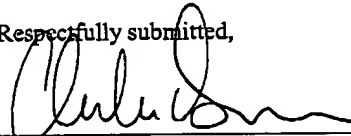
operation of the DBR and VCSEL), then the teachings of the references are not sufficient to render the claims *prima facie* obvious (see *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959)).

In contrast, by using InP as in the present DBRs, the Applicants' have also demonstrated far better thermal properties for the DBR (e.g., FIG. 14) as compared to the InAlAs or InGaAlAs materials of the '307 patent.

Accordingly, it is requested that the rejections applied be traversed.

Thus, in view of the above, it is submitted that this application is now in good order for allowance, and such early action is respectfully solicited. Should matters remain which the Examiner believes could be resolved in a telephone interview, the Examiner is requested to telephone the Applicants' undersigned attorney.

Respectfully submitted,



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